

**THE SYNONYMY OF *ALBULA VULPES* (LINNAEUS, 1758)
(TELEOSTEI, ALBULIDAE)**

by

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ABSTRACT.— Most authors have hitherto recognised a single worldwide species of bonefish, *Albula vulpes* (Linnaeus, 1758), but recently it has been shown, initially by biochemical techniques, that there are in fact two distinct species of *Albula* in Hawaiian waters. Since it is likely that the genus may be further split, the status and types (or iconotypes) of all 23 nominal species within *Albula vulpes sensu lato* are reviewed here as an aid to the selection of the correct binomial.

RÉSUMÉ.— La plupart des auteurs ont jusqu'à présent reconnu une seule espèce d'Albulidae, *Albula vulpes* (Linnaeus, 1758), de répartition mondiale. En faisant appel à des techniques biochimiques, on a montré récemment la présence de deux espèces distinctes d'*Albula* dans les eaux hawaïennes. Puisqu'il est probable que le genre sera divisé, et afin d'aider au choix de binomes corrects, le statut et les types (ou iconotypes) des 25 espèces nominales reconnues sous le nom *Albula vulpes sensu lato* sont passés en revue.

Keywords : Teleostei, Albulidae, *Albula vulpes*, Taxonomy, Holotypes, Synonymy.

INTRODUCTION

Wide-ranging fish species usually show some morphometric, meristic or other variation, in the past variously interpreted (races, subspecies, varieties, forms, etc.), or ignored. Modern biochemical techniques have also identified differences that may warrant taxonomic recognition. Although these biochemical results do not supercede traditional taxonomic characters, frequently they allow apparently random variations in the latter to be resolved into hitherto unsuspected bi- or multimodal patterns that give further justification for the fractioning of the taxon. However, those who practice techniques of protein analysis, microcomplement fixation, DNA restriction endonuclease mapping and sequencing, or karyology, are usually not those skilled in the complexities of early literature and typification. Yet, these are essential if the new taxa are to be identified with existing names or if, in default, a new name is to be proposed.

The nature of eighteenth and nineteenth century ichthyology ensured that in general, the more widespread a species, the more likely that it would accumulate a long synonymy, initially because early ichthyologists did not (or could not) use comparative material from other areas, subsequently because characters were still sufficiently crude that they favoured taxonomic « lumping ». Among numerous

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examples can be cited the sailfish *Istiophorus platypterus* (Shaw & Nodder, 1790), a distinctive world-wide fish that acquired at least ten synonyms before being considered as a single species (Morrow & Harbo, 1969; but now split into two by Nakamura, 1985); the grouper *Epinephelus tauvina* (Forsskål, 1775), widespread in the Indo-Pacific, for which twenty-four synonyms were found by Weber & de Beaufort (1931 : 60); and even the common European herring *Clupea harengus* (Linnaeus, 1758), with six synonyms (Whitehead, 1986).

Although the taxonomic literature abounds in synonymies, these are often uninformative about actual type specimens. An exception is the *Check list of fishes of the Northeastern Atlantic and of the Mediterranean* or *Clofnam* (Hureau & Monod, 1973). Even when types are mentioned in the literature, however, there are often traps for the unwary. Thus, Günther's numerous type designations in his *Catalogue* (1859-70) must be treated with great caution, even when he is considered to have been the first reviser. The difficulties in deciding exactly what are the types of species are well illustrated in the cases of Pieter Bleeker, Francis Day and Achille Valenciennes (Whitehead, Boeseman & Wheeler, 1966; Whitehead & Talwar, 1978; Whitehead, 1967b). Only very recently has typification of Linnaean fishes been brought to a scholarly level worthy of the patriarch of taxonomic nomenclature (Fernholm & Wheeler, 1983; Wheeler, 1985). Rather serious problems can arise when the species was based on a drawing, a manuscript written by somebody else, or on a pre-Linnaean literature reference, since a fairly detailed historical knowledge is often needed in order to locate the drawing, manuscript or reference, or definitely to exclude the possibility that a specimen exists.

Searching for types is a time-consuming business and many ichthyologists dismiss it on the mistaken assumption that types are mere eighteenth or nineteenth century relics of an age when single specimens were thought to epitomise a species. In fact, types are nothing more than *nomenifers* or 'name-bearers'. However, in this role they are vital in the support they give to a nomenclatural system that, with all its drawbacks, still provides the most rational and disciplined retrieval method for biological data. The physical evidence of what the author had before him when he composed the description, while in no way a total expression of the species that he had in mind, nonetheless can usually resolve problems concerning the true identity of that species. Even when that physical evidence is merely a skeleton, a fish skin or a drawing (i.e. iconotype), from which modern diagnostic characters cannot be extracted, it is often possible to recognise the species from correlated features.

The example chosen here is the wide-ranging bonefish *Albula vulpes* (Linnaeus, 1758), a species found in virtually all tropical and subtropical coastal waters (see map, Fig. 1). In just under a century following its description in the 10th edition of the *Systema naturae*, the species accumulated no less than twenty-one synonyms, with two final names proposed after that (1899 and 1922). From about 1940, however, these twenty-three synonyms have been lumped by virtually all authors under the name *vulpes*, with two exceptions: *glossodonta* was used by Steinitz & Ben-Tuvia (1955:4), and *neoguinaica* was used by Munro (1967:40).

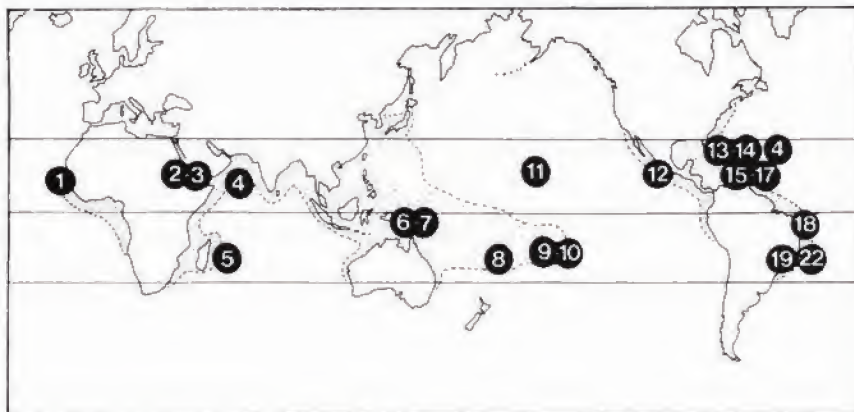


Fig. 1. — Approximate distribution (stippled) of *Albula vulpes* (*sensu lato*) and the type localities of its synonyms.

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| 1. <i>Albula goriensis</i> : Gorée, Senegal | 12. <i>Atopichthys esunculus</i> : Acapulco, Mexico |
| 2. <i>Argentina glossodonta</i> : Djedda or Lohaja, Red Sea | 13. <i>Esox vulpes</i> : Bahamas |
| 3. <i>Argentina bonuk</i> : on <i>glossodonta</i> (see above) | 14. <i>Amia immaculata</i> : Cuba |
| 4. <i>Albula rostrata</i> : Indian Ocean (also western Central Atlantic) | 15. <i>Clupea macrocephala</i> : Martinique |
| 5. <i>Butyrinus bananus</i> : Mauritius | 16. <i>Albula conorthynchus</i> : Antilles (also Brazil ?) |
| 6. <i>Albula neoguinaica</i> : New Guinea | 17. <i>Albula plumieri</i> : Antilles |
| 7. <i>Albula seminuda</i> : New Guinea | 18. <i>Clupea brasiliensis</i> : Bahia, Brazil |
| 8. <i>Albula eruthrocheilus</i> : Friendly Islands | 19. <i>Engraulis sericus</i> : Brazil |
| 9. <i>Esox argenteus</i> : Tahiti (also Tanna, New Hebrides) | 20. <i>Engraulis bahiensis</i> : Bahia, Brazil |
| 10. <i>Albula forsteri</i> : Tahiti | 21. <i>Albula parrae</i> : Bahia and Rio de Janeiro, Brazil |
| 11. <i>Albula virgata</i> : Hawaii | 22. <i>Glossodus forskalii</i> : Bahia, Brazil |
| | — — <i>Esunculus costai</i> : locality unknown |

Until quite recently the genus *Albula* has remained monotypic, but it now seems agreed that *Dixonina nemoptera* Fowler, 1911 of the western Central Atlantic and eastern Central Pacific, distinguished almost solely on its possession of filamentous last dorsal and anal finrays, is a second species of *Albula* (Rivas & Warlen, 1967). However, taxonomists have hitherto been curiously reluctant to tamper with *vulpes* itself, by recognition of forms, races or subspecies. Unexpectedly, therefore, the first split has been at species level and at somewhat of an outpost in the bonefish's distribution : Hawaii. Shaklee & Tamaru (1981), using electrophoretic analysis of the protein products of 84 presumed gene loci, found that there are two sympatric (but perhaps not syntopic) species of *Albula* in Hawaiian waters, with fixed allelic differences at about 70 % of the loci screened and a calculated genetic distance of 1.16. Armed with these results and using stepwise discriminant function analysis for 31 morphometric and meristic characters, they found it possible to correlate morphological differences that had appeared insignificant until then. A similar strategy confirmed that there are in fact two species of sprat in New Zealand waters (Whitehead, Smith & Robertson, 1985) and no doubt such findings will become commonplace.

In naming the two Hawaiian species of bonefish, Shaklee & Tamaru (1981) identified their Type A as *Albula neoguinaica* Valenciennes, 1847 (type locality New Guinea), and their Type B as *Albula glossodonta* Forsskål, 1775 (type locality the Red Sea). The holotype and paratype of the Hawaiian *Albula virgata* Jordan & Jordan, 1922 were found to be respectively *A. neoguinaica* and *A. glossodonta*. If, as seems likely, further species are split off throughout the huge range of *Albula vulpes*, then further nomenclatural difficulties could arise, types will need to be located and names and dating investigated. To anticipate this, not only the species but also the generic synonyms are reviewed here in case even more fundamental differences are found.

The following abbreviations for institutions have been used :

BMNH	British Museum (Natural History), London
FMNH	Field Museum of Natural History, Chicago
MCZ	Museum of Comparative Zoology, Harvard
MNHN	Museum National d'Histoire Naturelle, Paris
SU	Stanford University collections at Academy of Natural Sciences, San Francisco
ZMC	Zoologisk Museum, Copenhagen.

GENERIC SYNONYMS

Conorynchus Nozeman, 1758, *Uitgez-Verh.Amst.*, 3 : 381, pl. 25, figs 1-5 (*nomen oblitum*).

Conorhynchus : Gill, 1861, *Proc. Acad. nat. Sci. Philad.*, Suppl. : *Cat. Fish. east coast. N. Amer.* : 55 (name from Nozeman, misspelt).

Type : *Conorhynchus macrocephalus* Lacepède, 1803, designated by Gill (1861 : 55).

Note : Nozeman's description and figures (whole fish, upper and lower views of head, pattern of scales and an excellent drawing of an individual scale) leave no doubt that a species of *Albula* was meant; unfortunately, he gave no species name, he implied that the tongue was toothless (in fact, lacked the small fine teeth of the lower jaw), and he gave the locality as *de Middellandse Zee*. Gronovius borrowed from the description, cited the finray counts, and perpetuated the error that *Albula* occurs in the Mediterranean (see under *Albula* below). Nozeman nevertheless had a specimen to hand, so it must have been mislabelled. Since the 10th edition of the *Systema naturae* is arbitrarily dated 1 January 1758 (Article 3 of the International Code), Nozeman's *Conorynchus* is available and it well pre-dates Scopoli's *Albula* of 1771. However, the name *Albula* is so much entrenched in the literature that *Conorynchus* must be deemed a *nomen oblitum* and should be rejected by the Commission (Article 79(c) of the Code); even its subsequent resurrection by Gill (1861:55), who seems to have been the first author to give it priority, failed to establish the name in the literature.

Albula Gronovius, 1763, *Zoophylacii Gronoviani fasciculus primus* : 102 (unavailable).

Type : *Clupea macrocephala* Lacepède, 1803 = *Esox vulpes* Linnaeus, 1758; designated by Desmarest, 1874, *Encyclopédie d'histoire naturelle* (ed. Chenu), 19 : 309; see Whitley, 1939 : 225.

Note : A non-binominal work rejected by the International Commission for Zoological Nomenclature, Opinion 261 of 1954 (see also discussion in Opinions 20 and 89). Gronovius evidently never saw a specimen of *Albula* and appears to have based this genus solely on the literature; it is not in his earlier descriptions of his collection (Gronovius, 1754, 1756). He took the name *Albula* from Schonevelde (1624 : 11, 12, pl. 1), whose *Albula nobilis* seems in fact to have been the houting (*Coregonus oxyrinchus*), instead of using the much better diagnosed *Conorynchus* of Nozeman (although he cited Nozeman's meristic counts, toothless tongue and Mediterranean provenance). In a later manuscript (see under *Albula rostrata*) he added the western Atlantic and Indian Ocean, although still retaining the toothless tongue. The whole problem was well discussed by Valenciennes (1847 : 318 *et seq.*), who reviewed all the early literature and illustrative material and showed how confused the concept of *Albula* had been until then.

Vulpis Catesby, 1771, *Natural history of Carolina*, 2nd ed. : 1 (unavailable).

Type : *Esox vulpes* Linnaeus, 1758.

Note : a non-binominal work also rejected by the Commission in Opinion 259 of 1954 (see Opinion 13 and suppression in Opinion 89).

Albula Scopoli, 1771, *Introduction ad historiam naturalem... subinde ad leges naturae* : 450.

Type : *Esox vulpes* Linnaeus, 1758, by monotypy.

Butyrinus Lacepède, 1803, *Hist. nat. poiss.*, 5 : 45.

Type : *Butyrinus bananus* Lacepède, 1803, by monotypy. The name was misspelt *Butirinus* by Cuvier, 1829:324 (ignored in 1st ed.); *Butirinis* by Bleeker, 1854 : 508; and *Buturinus* by Valenciennes, 1847 : 316.

Glossodonta Cuvier, 1815, *Mém. Mus. Hist. nat. Paris*, 1 : 232; Cuvier, 1816, *Règne animal*, 1st ed., 2 : 164 (« quant à l'*argentina glossodonta* Forsk. elle m'est inconnue; je suppose que c'est un nouveau genre »).

Type : *Argentina glossodonta* Forsskal, 1775, by assumed tautonymy.

Glossodus Agassiz, in Spix & Agassiz, 1829, *Select. Gen. Spec. piscium Bras.* : 48.

Type : *Glossodus forskalii* Agassiz, 1829, by monotypy.

Esunculus Cope, 1856, *Cat. apodal fish. Brit. Mus.* : 143.

Type : *Esunculus costai* Kaup, 1856, leptocephalus, by monotypy.

Atopichthys Garman, 1899, *Mem. Mus. comp. Zool.*, 2nd : 326.

Type : *Atopichthys esunculus* Garman, 1899, designated by Jordan, 1920 : 486.

Dixonina Fowler, 1911, *Proc. Acad. nat. Sci. Philad.*, 62 : 651.

Type : *Dixonina nemoptera* Fowler, 1911, by monotypy.

Note : see Rivas and Warlen (1967) for placing this genus in *Albula*.

Apart from the first three, the remaining eight generic synonyms are available. Their geographical distributions (type species localities) are :
 Western Central Atlantic : *Albula*, *Conorynchus*, and *Dixonina*
 Western South Atlantic : *Glossodus*
 Red Sea : *Glossodonta*
 Western Indian Ocean : *Butyrinus*
 Eastern Central Pacific : *Atopichthys*
 No locality : *Esunculus*.

SPECIES SYNONYMS

Esox vulpes Linnaeus, 1758, *Syst. Nat.*, 10th ed. : 313.

Type locality : « America », possibly the Bahamas since *Vulpes bahamienis* of Catesby (1743) is cited as a synonym.

Type : Linnaeus gave meristic counts (D 14, P 14, V 8, A 10, C 17), but there is now no specimen in the Linnaean collections in Uppsala (Holm, 1957), Stockholm (Fernholm & Wheeler, 1983) or London (Wheeler, 1985). His branchiostegal ray count of *Triradiata* was presumably an error, since he diagnosed the genus *Esox* as having 8-13. However, his finray counts are very far from those given by Rivas & Warlen for western Atlantic specimens (D 18-19, P 17-19, V 9-11), also A 7-9. This makes it unlikely that Linnaeus really examined a specimen ; if he did, then it was not a specimen of western Atlantic *Albula*.

Note : whether he saw a specimen or not, the primary indication given by Linnaeus for *vulpes* does not refer to the species now generally understood as *Albula vulpes* Linnaeus of the western Atlantic ; only the secondary indication, the reference to Catesby's *Vulpes bahamiensis* (of which the figure is clearly *Albula*), allows the Linnaean name to be associated with this genus.

Argentina glossodonta Forsskal, 1775, *Descr. Anim.* : XIII, 68.

Type locality : Djedda or Lohaja, Red Sea.

Holotype : a dried skin (right side of head damaged), No. 63 in the Forsskal Collec-

tion, ZMC.

Note : this skin was examined, photographed and radiographed by Klausewitz and Nielsen (1965:25, pl. 36, No. 63 upper and lower). Finrays, scales, some intermuscular bones and branchiostegal rays can still be counted. Shaklee & Tamaru (1981) have now recognised this species as distinct, with a distribution extending from the Red Sea to Hawaii. The use of *glossodon* by Bleeker (1868:300 and elsewhere) and Günther (1909:385) can be considered as merely an unjustified emendation.

Esox argenteus G. Forster, 1777, *Voyage round the world*, 2 : 282 (*nomen nudum*). *Synodus argenteus* Schneider, 1801, *Syst. ichthyol. Bloch.* : 398 (not *Esox argenteus* Gmelin, 1789 - see below).

Esox argenteus : Lichtenstein, 1844, *Descr. animal.* : 196 (also 257, name only).

Type locality : Tanna, New Hebrides, 7 August 1774 (G. Forster); Tahiti, 17 August to 1 September 1773 (Schneider, Lichtenstein).

Holotype : not listed by Bertin (1940 : 260-262), but in fact MNHN 5415, being the only known Forster *Albula* specimen still extant. In 1782 this specimen, then in the possession of Sir Joseph Banks in London, was one of 23 fishes given to Pierre Broussonet and taken back for study to Montpellier. Around 1828 it was one of 44 fish specimens sent from Montpellier to Cuvier in Paris (Whitehead, 1978b : 62) and the specimen has since been documented (Bauchot, 1969 : 129).

Note : Georges Forster failed to give sufficient information to establish the name, merely stating that they caught « three hundred weight of mullets and other fish », adding a footnote « Particularly a sort common in the West Indies and there called ten-pounders (*esox argenteus*) ». This does not satisfy Article 16 of the *Code* as an indication.

Esox argenteus was first described by George's father J.R. Forster in his natural history journals written during the second of Captain Cook's voyages (in 4 volumes, now MSS Lat. qu. 133-136, Staatsbibliothek Preussischer Kulturbesitz, West Berlin). *Esox argenteus* appears in Vol. 2, p. 122. The fish was caught in Tahiti, probably in late August and it was drawn there by George Forster (pencil, uncoloured) and inscribed « *Esox argenteus* / Silvery. Fins Blackish, a yellow spot under & at (deleted) in the base of PP & PA / *Polynemus* / Mohee / Taheitee ». The drawing is now f. 234 in the Forster collection of zoological drawings, BMNH (Whitehead, 1978a : 39). The species was seen again at Tanna in the New Hebrides on 7 August 1774 and it was on this occasion that George Forster recorded it in his *Voyage round the world* and first published the name *Esox argenteus*. He was incorrect in equating it with the so-called tenpounder of the Caribbean, which is *Elops saurus*.

The next to apply the Forster's name *argenteus* to a species of *Albula* was Schneider (1801 : 398). For his *Synodus argenteus* he referred back two pages to his transcription of J.R. Forster's ms description, which Schneider had either read or taken from Bloch's notes; neither Bloch nor Schneider, however, ever saw the drawing, which was still with the other Cook voyages drawings with Sir Joseph

Banks in London.

Schneider would thus seem to have validated J.R. Forster's name *argenteus*. Unfortunately, twelve years earlier Gmelin (1789:1393), without ever seeing J.R. Forster's ms descriptions or George Forster's drawings, took the name *Esox argenteus* from George Forster's *Voyage round the world* and applied it to quite another fish, J.R. Forster's *Esox alepidotus* discovered in New Zealand freshwaters (Vol. 2, p. 62 of J.R. Forster's ms ; f. 235 of George Forster's drawings). Schneider was rightly confused by this and, after a major heading *Esox argenteus*, stated « Est *Esox alepidotus* J.R. Forster MS. II.62 », followed by Forster's description of that species. He then stated « Contra quem *argenteum* vocavit J.R. Forster MS. II.122 » and gave the true description of *argenteus*, with a note that he followed Bloch in assigning the species to *Synodus*. Although it is clear that Gmelin was mistaken and that if he had consulted the Forster mss he would have applied the name *alepidotus* and not *argenteus*, one cannot dismiss his authorship of the latter name and its subsequent application. It was used, for example, by Cuvier (1816:184) in the sense of a galaxiid fish and the most recent reviser of the New Zealand galaxiids, McDowall (1970: 352), has recognised the giant kokopu as *Galaxias argenteus* (Gmelin, 1789). The confusion was well reviewed by Valenciennes (1846: 351-354).

J.R. Forster's ms descriptions were eventually published by Lichtenstein (1844), virtually without alteration, but often with Lichtenstein's own identification given in a footnote. For *Esox argenteus* he gives *Synodus argenteus*.

Clupea brasiliensis Schneider, 1801, *Syst. ichthyol. Bloch.* : 427.

Type locality : Brazil, presumed Recife (see below).

Type : based on *ubarana* of Marcgrave (1648:154, fig.).

Note : Georg Marcgraf worked principally in Recife (1638-1643), but he visited other parts of Brazil, at least as far south as Salvador and north to perhaps the Rio Grande (Whitehead, 1973:187, also 1979). His description and woodcut of *ubarana* appear to contain little that might separate Schneider's *brasiliensis* from *vulpes* or any of the other nominal species in the western Atlantic. However, since the book is rare and the description is in Latin, the following translation is given here in case some unsuspected clues are contained :

UBARANA (indigenous name), is a fish similar to our trout almost the same in size, with the back a little elevated, a little straight to the caudal. The body is elongated, cylindrical, but a little squarish, a foot in length and half a foot in depth. The head is elongate or dilated, not large; the eyes the size of a *stuiver*, with the pupil black, surrounded by a mainly golden circle and silvery toward the outside. The mouth is bare of teeth and has a kind of stone that serves as a tongue. In the middle of the back this fish has a single fin of the length of about two inches and the height of one in the leading part, trapezoid in form, not rigid, but with two hard spines. Behind the gill opening on each side one finds a small fin, elongate and narrowing in its lower part; one finds equally two lateral ones, joined in the lower part to the body, in front of the dorsal; finally, there is a small one close to the anus. Regarding the caudal, it is a bifurcated fin similar to that of a herring, of more than two inches in length. It has small scales disposed in a linear order over the whole extent of the body so neatly as to be smooth to touch in what ever way. Seen from above

it is olive, but seen from a distance or from the side, it appears silvery and shining; the back is bluish silver; the belly white; the gill covers are smooth, in a way that appears laminated with silver. Roasted, it has a good taste and it is not necessary to remove the scales. Boiling is not convenient because of the quantity of spines dispersed in the flesh.

Most of Marcgraf's woodcuts are represented by small oil paintings (in 4 vols, *Theatri*) or watercolours (2 vols, *Handbooks*). These, formerly in the Preussischer Staatsbibliothek in Berlin, are now in the Jagiellon Library in Cracow, Poland (Whitehead, 1979; Whitehead & Boeseman, 1986). Both Bloch and Schneider knew the two volumes of watercolours (but apparently spurned using the oil sketches), and indeed Bloch had 24 of the fishes redrawn for the plates of his *Naturgeschichte der Ausländischen Fische* (Whitehead, 1979: 459, fn. 208); the originals for Bloch's plates are four volumes, the first two lost, the second two (for pls 201-431) now in the Zoologische Museum, Berlin (ZMB 60: 1375-6). Although Bloch did not use it or have it copied, the picture of *ubarana* matching Macgraf's woodcut is a pencil sketch in *Handbook*. 2: 339 (107 mm fork length) and it was certainly seen by Schneider, who seems to have been the one who labelled it *Clupea brasiliensis*. It should, therefore, stand as the nearest approach to Macgraf's intentions and thus a 'vicarious' iconotype (see Discussion, p. 10).

Albula conorhynchus Schneider, 1801, *Syst. ichthyol. Bloch.*: 432.

Type locality: Mediterranean (*teste* Gronovius, 1763:102), Antilles (*teste* Plumier drawing), Jamaica (*teste* Browne, 1754: 442), possibly also Brazil (if Marcgraf's *ubarana* was included). It is not clear how much Schneider accepted from his sources; Fowler (1941: 530) assumed the Antilles, while Hildebrand (1964: 141) took the type locality as not only the Western Atlantic, but also the Mediterranean. Schneider also referred to Renard (1718: pl. 34, f. 184), but his fish was *Chanos*.

Type: the description appears to have been made without reference to a specimen, thus it is Schneider's species and not Bloch's. There are no extant specimens which would support any of Schneider's sources and which might thus be considered 'vicarious' types (not in the Gronovius collection in BMNH - Wheeler, 1958; no Plumier or Browne specimens known). The nearest approach to a type is Schneider's pl. 85. Although labelled *Albula plumieri*, Schneider clearly equated it with his *conorhynchus*, implying a subsequent change of mind when he came to compose the text and propose a name. Since *plumieri* is essentially a name proposed in synonymy, then the figure of it must be the iconotype of the senior synonym, *Albula conorhynchus*, and the original drawing for that figure will be the 'vicarious' iconotype (see next species).

Albula plumieri Schneider, 1801, *Syst. ichthyol. Bloch.*: pl. 86.

Type locality: Martinique, since based on Plumier drawing.

Type: Schneider's pl. 86 is the only basis for the name and must stand as the iconotype, with the drawing of Plumier as its source (see below).

Note: although satisfying Article 16(a)(vii) of the *Code* as an "indication", the name *plumieri* is invalid because Schneider clearly refers to his pl. 86 as applying to his *Albula conorhynchus*, thus making *plumieri* a name first published in synonymy (Articles 11(d) and 16(b)(ii) of the *Code*). If the figure of *plumieri* is thus

regarded as illustrating *conorhynchus*, then it is still of interest to determine its source. Since Bloch seems not to have had a specimen of *Albula*, it cannot have been drawn for Schneider from Bloch's collection. However, Schneider (1801:XVI), in his *Lectoribus S. Editor*, after making some disparaging remarks about Marcgraf's Brazilian pictures, says how much more accurate were the Plumier fish drawings, to which Plumier had added notes and often a description as well as a drawing of some internal parts, the drawings having been copied by Bloch's artist (although not always very well). This implies that Bloch had access to the Plumier drawings, and indeed Bloch himself stated in the introduction to the *Naturgeschichte* that he had his illustrations either made from nature, or *aus den vortreflichen Handzeichnungen des paters Plümier* (Bloch, 1785). In fact, Bloch illustrated 34 species on 31 plates of the *Naturgeschichte* with engravings marked *Pater Plümier del.*, *P. Plüm. del.* and other variants. Schneider (1801) implied that Bloch had his own collection of Plumier drawings (as assumed by Karrer, 1978), contrasting them with those used by Lacepède (e.g. for his *Clupea macrocephala*, see below), which were "from some source or other" (*exemplar nescio unde*), i.e. not the ones used by Bloch. Valenciennes (1847: 318) believed that Bloch and Lacepède used different sources since Bloch « faisait graver l'original de ce velin sous le nom d'*Albula plumieri* », thus implying that Lacepède used a *velin* and Bloch the original of it. Comparing the Schneider (Bloch) engraving of *Albula plumieri* with the Lacepède engraving for *Clupea macrocephala*, one can see that the two differ in the position of the pelvic fins (further forward in Lacepède), the length of the pectoral fins (shorter in Lacepède), and the number and size of scales (smaller in Lacepède). This does indeed reflect their sources. The original drawings made by Father Charles Plumier in Martinique are now in four volumes in the Bibliothèque Centrale of the Muséum National d'Histoire Naturelle in Paris (MSS 23-25 and 31, the first entirely botanical, the rest including *inter alia* 272 folios devoted to fishes, mostly one per page). An ink drawing of a species of *Albula* is in MS 24: 4, with a cross-section of the body and the inscriptions « *Vurabana brasiliensibus G. Marcgr. LIV, CVII 154* » and « *Vulgo Banane apud insulas americanas* ». In the collection of *velins* in the same library, however, are copies of some of the Plumier originals, including (Vol. 93:62) a copy of Plumier's *Albula*, made by Claude Aubriet (as stated in a tracing of it in the manuscripts for the *Histoire naturelle des poissons*, MS 518, XIX:18, see under *Butyrinus bananus* below). It is curious that Lacepède clearly used the *velin*, but gave the smaller scales of the original. Whether Bloch borrowed and used the original Plumier drawings, or whether he had copies made and sent to him is not clear, but the Plumier original of *Albula* (MS 24. 4) is certainly the 'vicarious' iconotype of Schneider's *plumieri*, thus also of his *conorhynchus*, while the *velin* by Aubriet (Vol. 93:62) is the iconotype of Lacepède's *Clupea macrocephala* (see that species).

Amia immaculata Schneider, 1801, *Syst. Ichthyol. Bloch.* : 451.

Type locality : Cuba.

Type : based solely on *macabi* of Parra (1787: 88, pl. 35, figs 1,3-5), who gave his collection to the Real Gabinete in Madrid; in the Museo Nacional de Ciencias Naturales, Madrid, are 7 certain and 25 probable Parra fishes, but not the *macabi*.

Note : Antonio Para devoted forty-one chapters to fishes around Cuba, each one illustrated by a not very skillful engraving. Since the book is rare and the description may contain some hint at the true identity of the species, a translation is given here :

MACABI. The largest that we know was thirty-five *pulgados* long and eighteen deep [*pulgada* = 2,3 cm]. The head has a pyramidal shape, the two sides and the lower one larger than the upper. The eyes are situated in the middle and upper part of the sides, round and the size of a *real* piece; their colour blue in the pupil, white-veined tinged red and yellow. Their mouth, inferior, is tiny in proportion to the length [of the fish]. The upper jaw is more prolonged than the lower; both the one and the other have the edge scattered with countless fine and pointed teeth; with these it chews its food [and] can for this purpose use other means, which will be mentioned at the end of the description. The body appears to have the same bulk from the head to the pelvic fins; from there to the tail it diminishes rapidly. It has six fins, two jugular, two *del ano* [of the anus, i.e. pelvics], one dorsal, and one below on the caudal peduncle; the dorsal lies in the middle of the back and is four inches long and four and a half at its highest. The tail is forked at an obtuse angle. The fins and the tail have a thick bony filament. The colour of the upper side of the head is dusky, the sides and the lower part silvery and the same on the rest of the body. The scales, which appear tiny because of the small part exposed, are quite large and very numerous. To the fishermen it is known for its many spines; such that it must be eaten with much care and is the reason it is little appreciated.

The chewing organs are four pieces, a convex oval that corresponds to the tongue, Figure 3, and three concave ones that correspond to the palate, as shown in Figure 4 [actually, Fig. 3 is the palate and Fig. 4 is the tongue]. The four pieces are covered with little white grains of different sizes, inlaid into the bony part like stones in a ring; in hardness they are like marble and the enamel of teeth, and these are what they masticate with and chew the food until in a final state to swallow. The air bladder, Figure 5, much resembles a parsnip, being thirteen *pulgadas* long and at its widest part five and a half.

It is especially interesting to have the toothplates of the palate and the tongue described and even illustrated, since this is one of the major characters used by Shaklee & Tamaru (1981 : Fig. 4, photo) to distinguish *Albula neoguinaica* from *A. glossodonta*; Parra's *macabi* more closely resembles *A. glossodonta* in this respect, especially in the more squat basihyal toothplate.

Butyrinus bananus Lacepède, 1803, *Hist. nat. poiss.*, 5 : 46, also pl. 8, fig. 2 (as *Synode Renard*).

Type locality : Mauritius.

Type : Lacepède claimed that he used a short and precise description found among the Commerson papers, but curiously he did not refer to the Commerson drawings of this fish. However, he used one of them as the basis for his *Synod Renard* of pl. 8, fig. 2, which in his text he calls *Synodus vulpes*. Valenciennes (1847 : 347) failed to find such a Commerson description and suspected that Lacepède wrote his diagnosis from the drawing. The Commerson manuscript descriptions (mostly botanical) were listed as Nos 51-71 by Laissus (1978 : 155), of which Nos 56 and 65 (in 9 folders) deal with fishes (MS 889 in the Bibliothèque Centrale of the Muséum National d'Histoire Naturelle). Cuvier regrouped these fish descriptions

and made copies of those of interest (now MSS 890-893 in the Bibliothèque Centrale). It seems reasonable to consider the two drawings as iconotypes in the absence of a Commerson specimen; these drawings are MS 93: 63 and 64 in the Collection des Velins du Muséum in the Bibliothèque Centrale. Both drawings are in ink and are inscribed:

- No. 63 : *recto* « Synode renard Lac T.V. pl. 8 no. 2, page 317
verso « Butyrinus Le Poisson-Banane » (written by Commerson), and « Lac T V page 308, pl. 8 No. 2 Synode renard. »
 No. 64 : *recto* « Butyrinus Poisson banané vulgo », « Grand comme nature »
verso « Lac T.V. page 307 pl. 8 No. 2 Synode renard ».

Bertin (1940: 261) incorrectly listed three paratypes for *Butyrinis bananus*; these were collected by Desjardins and Dussumier, thus some years after Lacepède had published the name.

Note : The Commerson drawings, formerly combined with all the other zoological drawings (which are now MS 282 in the Bibliothèque Centrale), were separated by Cuvier and put into the collection of *velins* (Vols 89-94), being 175 crayon and ink drawings (Whitehead & Bauchot, 1986). Copies were made of 97 of these (red or black crayon, or ink, some partly coloured) and these were used by both Cuvier and Valenciennes. In 1845, four years before completion of the *Histoire naturelle des poissons*, Valenciennes sent these copies to Alexander von Humboldt in Berlin and these are now in a bound volume in the Jagiellon Library in Cracow, Poland (Whitehead, van Vliet & Stearn, in prep.). Tracings of some of the Commerson drawings were also made and these are arranged systematically in folders with other manuscript material, volume by volume, for the *Histoire naturelle des poissons* (MS 480-558 in the Bibliothèque Centrale, see Laissus, 1978: 161-162; they have been reviewed by Pietsch, 1985). The tracings of the two *Albula* drawings are in MS 518, XIXB: 30 and 33. Thus there are often two copies as well as the original for certain fishes (Bertin, 1945: 14, noted how Lacepède on at least one occasion proposed three distinct species based on three different states of a drawing!).

It should be pointed out that Lacepède probably never used actual Commerson specimens for his descriptions. In March 1791, having resigned from the Jardin des Plantes, he took refuge in the country at Leuville to escape the revolutionary situation in Paris and until the fall of Robespierre. It has been assumed that he studied the Commerson fishes from notes during his stay at Leuville, and while he may have again consulted the drawings and manuscripts on his return to Paris following his appointment to the chair of Ichthyologie and Herpetologie in January 1795, the Commerson specimens were either not available or he did not use them (see Bertin, 1945 for an excellent biographical sketch). It often happens, therefore, that Lacepède's descriptions do not accord with the actual Commerson specimen.

Argentina bonuk Lacepède, 1803, *Hist. nat. poiss.*, 5 : 365, 366.

Type locality : Arabian Sea (i.e. Red Sea).

Type : none.

Note : Lacepède based his description on Forsskål's *Argentina glossodonta*, with reference to Gmelin's use of this name in the 13th edition of the *Systema naturae* (Gmelin, 1789:1394), but he chose to take the name from Forsskål's vernacular as used by Bonnaterre (1788:177, pl. 73, fig. 303). Lacepède clearly had no specimen and no drawing, but provision of a neotype is unnecessary since *bonuk* is essentially a replacement name for Forsskål's *glossodonta*.

Clupea macrocephala Lacepède, 1803, *Hist. nat. poiss.*, 5 : 426, 460, pl. 14, fig.1.
Type locality : Martinique.

Type : based on a *velin* by Aubriet (Vol. 93:62), copied from a Plumier original (probably MS 24:4), as explained under *Albula plumieri* above. Unlike the original, the *velin* is coloured; it is inscribed « *Cephalus argenteus Plumieri* », « vulgo Banane à la Martinique » and « *Clupée macrocephale*. *Clupea macrocephala* Lac T.V. page 458, pl. 14 no. 1 ». Lacepède (1803:464) explained that « nous avons trouvé une figure [of *macrocephala*] sur une des peintures exécutées sous les yeux de Plumier, et insérées par les Professeurs du Muséum d'Histoire Naturelle... », which seems to imply that Plumier himself gave instructions for the colours, presumably to the copyist Aubriet.

Glossodus forskalii Agassiz, in Spix & Agassiz, 1829 (May to June, most likely near end of June), *Select. gen. spec. pisc. Bras.* : 49.

Type locality : Brazil (Belem, São Luis, Salvador, Ilheus, Rio de Janeiro are all possible).

Type : Some Spix and Agassiz specimens were deposited in Munich, but these were destroyed during the bombing of 24/25 April 1944; others were sent by Martius from Munich to Agassiz in Neuchâtel; a number of these survive, but none of *Glossodus forskalii* (Kottelet, 1984).

Engraulis sericus Spix, in Spix & Agassiz, 1829, *Select. gen. spec. piscium Bras.* : pl. 23, fig. 2.

Type locality : Brazil (see previous species).

Note : the name was engraved on the plate and can be attributed to Spix since Cuvier referred to this Spix name (and equated it with *glossodonta* and *plumieri*) on November 1827, or a month or two before Agassiz was invited by Martius to complete Spix's work on the book (Whitehead & Myers, 1971:479, also 487; Cuvier's note). The name *sericus* first appeared as a junior synonym (cf *forskalii*) and is thus invalid (Articles 11(d) and 16(b)(ii) of the *Code*).

Engraulis bahiensis Spix, in Spix & Agassiz, 1829, *Select. gen. spec. piscium Bras.* : pl. 24, fig. 2.

Type locality : Salvador.

Type : lost (see previous two species).

Note: the name *bahiensis* is also invalid (see previous species).

Albula parrae Valenciennes, 1847, *Hist. nat. poiss.*, 19 : 339.

Type locality : Martinique (also Bahia and Rio de Janeiro, Brazil).

Syntypes : Bertin (1940:261) listed two specimens, MNHN A823 and 9740 (a male and a female) from Martinique, collected by Auguste Plée and received in Paris in 1826, being one of five collections, together with notes, that Plée sent to Cuvier.

Albula goreensis Valenciennes, 1847, *Hist. nat. poiss.*, 19 : 342.

Type locality : Gorée, Senegal.

Syntypes : Bertin (1940:261) listed two specimens, MNHN 3586 and 3587, from Gorée, collected by the naval officer Paul Rang (a survivor of the shipwreck of the *Meduse*) and received in Paris in 1830.

Albula neoguinaica Valenciennes, 1847, *Hist. nat. poiss.*, 19 : 350.

Type locality : northwestern Irian Jaya, August or September 1927.

Holotype : Bertin (1940:261) listed a single specimen, MNHN 3591, collected by Jean-René-Constant Quoy and Paul Gaimard on the voyage of the *Astrolabe* and received in Paris in 1829.

Note : Shaklee & Tamaru (1981) considered this to be the second of the two Hawaiian species of *Albula*.

Albula seminuda Valenciennes, 1847, *Hist. nat. Poiss.*, 19 : 357.

Type locality : Irian Jaya (presumably together with the last species).

Holotype : Bertin (1940:261) listed a single specimen (in bad state), MNHN 3591, from New Guinea, also collected by Quoy and Gaimard on the voyage of the *Astrolabe* (see previous species).

Albula erythrocheilus Valenciennes, 1847, *Hist. nat. poiss.*, 19 : 352.

Type locality : Friendly Islands.

Holotype : Bertin (1940:261) listed a single specimen, MNHN 3593, from the Friendly Islands, also collected by Quoy and Gaimard (see previous two species).

Albula forsteri Valenciennes, 1847, *Hist. nat. poiss.*, 19 : 354.

Type locality : Tahiti.

Type : Bertin (1940:260-261) did not list the Forster specimen, holotype of *Esox argenteus*, which is MNHN 5415. It must stand as the type of *forsteri* also since Valenciennes merely supplied a new name for a described species.

Note : from Robert Brown at the British Museum, Valenciennes received a number of tracings of drawings, including some of the Forster drawings from Captain Cook's second voyage (Valenciennes, 1846:354). Tracings were also received from Sarah Bowdich, but possibly these were sent to Cuvier before Valenciennes began work on the *Histoire naturelle des poissons* : most or all of these tracings are now

in the manuscripts for the *Histoire naturelle des poissons* in the Bibliothèque Centrale (see under *Butyrinus bananus* above). Valenciennes used the Forster tracing of *Esox argenteus*, but he confirmed the identification from the specimen. He knew the reference by George Forster (1777:282), but he considered that the latter's *argenteus* had been blurred by Gmelin's application of the name to the freshwater *Esox alepidotus* (see under *Esox argenteus* above).

Albula rostrata Gray, 1854, *Cat. fish. Gronovius* : 189.

Type locality : « Oceano Americano, Indico et Mari Mediterraneo » (see below).

Type : there is no specimen of *Albula* in the Gronovius collection, BMNH (Wheeler, 1958) and the evidence suggests that Gronovius did not have one.

Note : Gray (1854) validated this and other Gronovius names by publishing a manuscript collection of Gronovius's notes (121 folio pages and 85 drawings or engravings), bought in London at auction together with the Gronovius fish collection in 1833 ; this manuscript, now bound as a volume, is in the Zoology Library, BMNH. The genus *Albula* is on f.245 and is followed immediately by the species *Albula rostrata*, but without any drawing. In the *Zoophylacii* (Gronovius, 1763:102), the genus *Albula* is diagnosed, without species, and this is more or less followed in the manuscript, except that Gronovius at a later date added to it. Although this might suggest that he saw a specimen, the persistence of the phrase *Lingua edentula* argues against this, and most likely he added from the literature. The locality in the *Zoophylacii* is merely Mediterranean, even though Browne (1756) and Renard (1718) appear in the synonymy (i.e. Jamaica and Indonesia). Presumably he later realised the omission and added Oceano Indico and Americano to the manuscript under *Albula rostrata*. In general, one must conclude that Gronovius's concept of *Albula*, and thus of *Albula rostrata* in particular, was vague and confused. The name *rostrata* suggests that perhaps Gronovius intended giving a name to Nozeman's species of *Conorhynchus* (see under *Albula* above).

Esunculus costai Kaup, 1856, *Cat. apodal fish Brit. Mus.* : 144, pl. 16, fig. 3.

Type locality : no locality specified, Kaup merely saying that he found the specimens in the Paris Museum and supposed the species to inhabit the Mediterranean.

Syntypes : Bertin (1940:262) listed six specimens (larvae of 4 to 6 cm, in poor condition), MNHN 3580.

Atopichthys esunculus Garman, 1899, *Mem. Mus. comp. Zool.*, 24 : 327, pl. 65, figs 2, 2a.

Type locality : Acapulco, Mexico.

Types : MCZ xxxxxx.

Albula virgata Jordan & Jordan, 1922, *Mem. Carnegie Mus.*, 10 : 6, pl. 1, fig. 1.

Type locality : Hawaii.

Types : the holotype is FMNH 55190 and the paratype is SU 23288. According to

Shaklee & Tamaru (1981), the holotype is *Albula neoguinaica* and the paratype is *A. glossodonta*. However, they did not consider the possible application of any of the names given to nominal species outside the Indo-Pacific area.

DISCUSSION

In the typification of species described in early works, or species based by later authors on early works, the term 'vicarious' is useful in defining the status of types (whether specimens or pictures). For example, when Schneider based his *Clupea brasiliensis* and *Amia immaculata* solely on the pre- or non-Linnaean descriptions and figures of Marcgraf and Parra, he himself saw no specimens that could now be regarded as types. Nevertheless, both Marcgraf and Parra had at least one actual specimen in front of them when they composed their descriptions and therefore, at one remove, such specimens underpin Schneider's secondary description. If such specimens are extant, then they can be considered 'vicarious' types of the Schneider species. They have no official retrospective status, but they deserve serious consideration in the selection of a neotype.

In the event, neither the Marcgraf nor Parra specimens exist. The next best physical evidence of what these early authors had before them is their illustrations. Since these are accompanied by a written description, they are not strictly iconotypes, i.e. the *sole* basis for the subsequent available name (by Schneider, for example). However, both Marcgraf and Parra had a prior sketch or drawing, based on the specimen(s) they described (or those they considered to be conspecific) and this is evidence of what they described. Therefore, at one remove, such original drawings eventually underpin Schneider's secondary descriptions. If extant, these drawings can be considered 'vicarious' iconotypes. In a similar way, the original drawing for a true iconotype, if not used (or seen) by the author of the available name (e.g. Schneider), also qualifies as a 'vicarious' iconotype. The importance of such 'vicarious' iconotypes lies in the often considerable amount of additional information that they contain, as for example fresh colours when the iconotype itself is a plain engraving.

Albula vulpes is perhaps not typical in the rather nebulous synonyms that it has gathered and the complexities of their non-Linnaean roots. However, while the Law of Priority remains the cornerstone of the *Code*, nomenclatural stability can only be ensured by a thorough exploration of these roots.

In the case of the twenty-three binomials circumscribed by *Albula vulpes sensu lato*, there are 5 names that are either unavailable or mere replacement names, and 18 that are available should the species be split; of these latter, 10 have type specimens, 2 have iconotypes, 2 have 'vicarious' iconotypes, and 4 have no material or original graphic support.

Available names

- Esox vulpes* Linnaeus, 1758 (no type known)
Argentina glossodonta Forsskal, 1775 (holotype)
Clupea brasiliensis Schneider, 1801 (vicarious iconotype)
Albula conorhynchus Schneider, 1801 (vicarious iconotype)
Amia immaculata Schneider, 1801 (vicarious iconotype)
Butyrinus bananus Lacepède, 1803 (iconotype)
Clupea macrocephala Lacepède, 1803 (iconotype)
Glossodus forskalii Agassiz, 1829 (no type known)
Albula parrae Valenciennes, 1846 (syntypes)
Albula goreensis Valenciennes, 1847 (syntypes)
Albula neoguinaica Valenciennes, 1847 (holotype)
Albula seminuda Valenciennes, 1847 (holotype)
Albula erythrocheilus Valenciennes, 1847 (holotype)
Albula forsteri Valenciennes, 1847 (holotype)
Albula rostrata Gray, 1854 (no type known)
Esunculus costai Kaup, 1856 (syntypes)
Atopichthys esunculus Garman, 1899 (syntypes)
Albula virgata Jordan & Jordan, 1922 (holotype, paratype)

Unavailable or replacement names

- Esox argenteus* G. Forster, 1777 (*nomen nudum*)
Albula plumieri Schneider, 1801 (unavailable)
Argentina bonuk Lacepède, 1803 (replacement)
Engraulis sericus Spix, 1829 (unavailable)
Engraulis bahiensis Spix, 1829 (unavailable)

It is unfortunate that *Albula vulpes*, the oldest synonym and thus the yardstick for all subsequent nominal species, lacks any form of type and rests on one of Linnaeus's characteristically telegraphic descriptions and one that bears little resemblance to *Albula* as currently understood. The provision of a neotype for *vulpes*, and preferably one whose biochemical characters have been explored within the context of western Atlantic populations, will serve to anchor the nomenclature of *Albula* species. Only from such a base-line, and using the literature described here, can the nomenclature of newly recognised species of *Albula* be fully secure.

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REFERENCES

- BAILEY R.M., 1915. — The authorship of the names proposed in Cuvier and Valenciennes' « Histoire naturelle des poissons ». *Copeia* (1) : 249-251.
 BAUCHOT M.-L., 1969. — Les poissons de la collection de Broussonet au Muséum National d'Histoire naturelle de Paris. *Bull. Mus. natn. Hist. nat. Paris*, (2) 41 (1) : 125-143.
 BERRY F.H., 1964. — Review and emendation : family Clupeidae. *Copeia*, (4) : 720-730.
 BERTIN L., 1940. — Catalogue des types de poissons du Muséum National d'Histoire Naturelle. (2e partie), dipneustes, chondrostéens, holostéens, isospondyles. *Bull. Mus. natn. Hist. nat. Paris*, (2) 12 (6) : 244-322.

- 1945. – Lacepède. *Bull. Mus. natn. Hist. nat. Paris*, (2) 17 (5) : 3-22.
- BLEEKER P., 1845. – Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der fauna. *Natuur. Geneesk. Arch. Neerl. Ind.*, 2 : 505-528.
- 1868. – Notice sur la faune ichthyologique de l'île de Waigou. *Versl. Meded. K. Akad. wet. Amst.*, (2) 2 : 295-301.
- BLOCH M.E., 1785. – *Naturgeschichte der Ausländischen Fische*, (1), Berlin, 126 pp.
- BOESEMANN M., 1962. – *Triodon micropterus* versus *Triodon bursarius* : an attempt to establish the correct name and authorship. *Zool. Meded. Leiden*, 38 (4) : 77-85.
- BROWNE P., 1756. – *The civil and natural history of Jamaica*. For the author, London, viii + 503 pp.
- CATESBY M., 1731-43. *The natural history of Carolina, Florida, and the Bahama Islands : containing the figures of birds, beasts, fishes, serpents, insects and plants... with their descriptions in English and French... Histoire naturelle de la Caroline...* parallel English and French texts), 2 vols. Benjamin White, London, xiv + 100 and [ii] + 100 + [vi] and Appendix, 20 + [ii].
- CUVIER G.L.C.F.G., 1816. *Le règne animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à anatomie comparée*, 1st ed., 2, Deterville, Paris, 532 pp. (often wrongly given as 1817, but dated 17 December 1816 by Whitehead, 1967a; corrected to: 7 December by Cowan, 1969; Roux, 1977, found evidence that all four volumes were presented to the Academy of Sciences on Monday, 2 December 1816, thus in print by late November).
- 1829. – *Ibid.*, 2nd ed., 2, Deterville, Paris, 406 pp. (dated between 15 February and 31 March by Boeseman, 1962).
- COWAN C.F., 1969. – Cuvier's *Règne Animal*, first edition. *J. Soc. Biblioph. nat. Hist.*, 5 (3) : 219.
- FERNHOLM B. & WHEELER A.C., 1983. – Linnaean fish specimens in the Swedish Museum of Natural History, Stockholm. *Zool. J. Linn. Soc.*, 78 : 199-286.
- FOWLER H.W., 1941. – Contributions to the biology of the Philippine Archipelago and adjacent regions. *Bull. U.S. natn. Mus.*, 13 (100) : 1-879.
- GILL T., 1861. – Catalogue of the fishes of the eastern coast of North America from Greenland to Georgia. *Proc. Acad. nat. Sci. Philad.*, Suppl. : 1-63.
- GMELIN J.F., 1789. – *C.a. Linne Systema naturae... Editio decimatertia... cura J.F. Gmelin*, 1 (3) : 1033-1516 (fishes often wrongly dated as 1788 – see Hopkinson, 1907 for dating).
- GRONOVIVS L.T., 1754. – *Museum ichthyologicum, systens piscium indigenorum & quorundorum exoticorum, qui in Museo Laurentii Theodori Gronovii*. T. Haak, Leiden, 70 pp., 4 pls.
- 1756. – *Musei ichthyologici tomus secundus*. T. Haak, Leiden, 88 pp., 3 pls.
- GÜNTHER A.K.L.G., 1909. – Andrew Garrett's Fische der Südsee, beschreiben und redigirt. *J. Mus. Godeffroy*, (16) : 261-505.
- HILDEBRAND S.F., 1964. – Fishes of the western North Atlantic, part 3. *Mem. Sears Fdn. mar. Res.*, New Haven, (1) : 1-630 (often cited as 1963, but published 1 March 1964 *vide* Berry, 1964).
- HOLM A., 1957. – Specimens Linnaeana i Uppsala beverade zoologiska samlingar fran Linnés tid. *Uppsala Univ. Arsskr.*, (6) : 1-68.
- HOPKINSON J., 1907. – Dates of publication of the separate parts of Gmelin's edition (13th) of the 'Systema naturae' of Linnaeus. *Proc. zool. Soc. Lond.* : 1035-1037.
- HUREAU J.-C. & MONOD Th. (eds), 1973. – *Check-list of the fishes of the north-eastern Atlantic and of the Mediterranean*, 2 vols. UNESCO, Paris, 683 + 331 pp.
- JORDAN D.S., 1920. – *The genera of fishes, from Linnaeus to 1920, with the accepted type of each. A contribution to the stability of scientific nomenclature*, Part 4. Stanford University Publ., University Series, pp. 411-576 + i – xviii.
- KARRER C., 1978. – Marcus Elieser Bloch (1723-1799). Sein Leben und die Geschichte seine

- Fischsammlung. *Sber. Ges. naturf. Freunde Berl.*, (NF), 18 : 129-149.
- KLAUSEWITZ W. & NIELSEN J.G., 1965. — On Forsskål's collection of fishes in the Zoological Museum of Copenhagen. *Spolia zool. Mus. haun.*, 22 : 1-29, 38 pls.
- KOTTELET M., 1984. — Catalogue des types du Musée d'Histoire Naturelle de Neuchâtel. I. Pisces. *Bull. Soc. Neuchât. Sci. nat.*, 107 : 143-153.
- LAISSUS Y., 1978. — Catalogue des manuscrits de Philibert Commerson (1725-1773) conservés à la Bibliothèque Centrale du Muséum national d'Histoire naturelle (Paris). *Revue Hist. Sci.*, 31 (2) : 131-162.
- LICHTENSTEIN M.H.K., 1844. — *Descriptiones animalium quae in itinere ad maris australis terras per annos 1772, 1773 et 1774 suscepto collegit observavit et delineavit Johannes Reinoldus Forster*. Dummler, Berlin, xvi + 42 pp.
- MARCGRAVE G., 1648. — *Historiae rerum naturalium Brasiliae...*, 8 books, 293 pp. in Piso, G. & Marcgrave, G., *Historia naturalis Brasiliae*, F. Haak, Amsterdam and Ludovic Elsevier, Leiden.
- MCDOWELL R.M., 1970. — The galaxiid fishes of New Zealand. *Bull. Mus. comp. Zool.*, 139 (7) : 341-431.
- MORROW J.E. & HARBO S.J., 1969. — A revision of the sailfish genus *Istiophorus*. *Copeia*, (3) : 34-44.
- MUNRO I.S.R., 1967. — *The fishes of New Guinea*. Dept. Agric. Stock Fisher., Port Moresby, New Guinea, 650 pp., 78 pls.
- NOZEMAN C., 1758. — Beschrijving van een zeldzamen vis [*Argentina* sp.]. *Uitgez. Verh. Amst.*, 3 : 381-386, figs.
- PARRA A., 1787. — *Descripcion de diferentes piezas de historia natural las mas del ramo maritima, representadas en setenta y cinco laminas*. Imprenta de la Capitanía General, Havana, 4 + 195 + 5 (unnn., index) pp.
- RENARD L., 1718 [19]. — *Poissons, écrevisses et crabes... que l'on trouve autour des isles Moluques, et sur les côtes des Terres Australes... Ouvrage... qui contient un très grand nombre de poissons... de la mer des Indes; divisé en deux tomes, dont le premier a été copié sur les originaux de M.B. Coyett... Le second tome a été formé sur les recueils de M.A. Vander Stell... avec une courte description de chaque poisson...* 2 vols (in one). Amsterdam [xviii] + 43 and 57 pls.
- RIVAS L.R. & WARLEN S.M., 1967. — Systematics and biology of the bonefish, *Albula nemoptera* (Fowler). *Fishery Bull. Fish Wildl. Serv. U.S.*, 66 (2) : 251-258.
- SCHONEVELDE A., 1624. — *Ichthyologia et nomenclaturae animalium marinorum, fluvialium, lacustrum, quae in florentissimus ducatibus Slesvici et Holsatiae & celeberrimo emporio Hamburgo occurrunt triviales ac plerorumq; bacterus desideratorum imagines, breves descriptiones, & explicationes*. Bibliopolio Heringiano, Hamburg, 87 pp.
- SHAKLEE J.B. & TAMARU C.S., 1981. — Biochemical and morphological evolution of Hawaiian bonefishes (*Albula*). *Syst. Zool.*, 30 (2) : 125-146.
- STEINITZ H. & BEN-TUVIA A., 1955. — Fishes from Eylath (Gulf of Aqaba), Red Sea. 2nd Report. *Bull. Sea Fish Res. Sfn Israel*, (11) : 3-15.
- VALENCIENNES A., 1846. — *Histoire naturelle des poissons*, 18. P. Bertrand, Paris, 505 pp.
- 1847. — *Ibid.*, 19, 544 pp. (1846 on title page, but dated May 1847 by Bailey, 1951).
- WEBER M. & DE BEAUFORT L.F., 1931. — *The fishes of the Indo-Australian Archipelago*, 6. E.J. Brill, Leiden, 448 pp.
- WHITEHEAD P.J.P., 1967a. — The dating of the 1st edition of Cuvier's *Le règne animal distribué d'après son organisation*. *J. Soc. Bibliophy nat. Hist.*, 4 (6) : 300-301.
- 1967b. — The clupeoid fishes described by Lacepède, Cuvier & Valenciennes. *Bull. Br. Mus. nat. Hist. (Zool.)*, Suppl. 2 : 1-180, 11 pls.
- 1973. — The clupeoid fishes of the Guianas. *Bull. Br. Mus. nat. Hist. (Zool.)*, Suppl. 5 : 1-227.
- 1978a. — The Forster collection of zoological drawings in the British Museum (Natural History). *Bull. Br. Mus. nat. Hist. (hist. Ser.)*, 6 (2) : 25-47.

- 1978b. — A guide to the dispersal of zoological material from Captain Cook's voyages. *Pacif. Stud.*, 2 (1) : 52-93.
 - 1979. — Georg Markgraf and Brazilian zoology, pp. 424-471 in E. van den Boogaart, H. Hoetink & P.J.P. Whitehead (eds), *Johan Maurits van Nassau, 1604-1679. A humanist prince in Europe and Brazil. Essays on the occasion of the tercentenary of his death*. Johan Maurits van Nassau Stichting, The Hague, 538 pp.
 - 1986. — FAO species catalogue, 7. Clupeoid fishes of the world. An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, anchovies and wolf-herrings, Part 1 - Chirocentridae, Clupeidae and Pristigasteridae. *FAO Fish. Synop.*, (125), 7 (1) : 1-303.
- WHITEHEAD P.J.P. & BAUCHOT M.-L., 1986. — Catalogue critique des types de poissons du Muséum national d'Histoire naturelle. *Bull. Mus. nat. Hist. natn. Paris*, (4), 7 (4, suppl.) : 1-77.
- WHITEHEAD P.J.P. & BOESEMANN M., 1986. — *A portrait of Dutch Brazil. Animals, plants and people by the artists of Johan Maurits of Nassau (1604-1679)*. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam.
- WHITEHEAD P.J.P., BOESEMANN M. & WHEELER A.C., 1966. — The types of Bleeker's Indo-Pacific elopoid and clupeoid fishes. *Zool. Verh. Leiden*, (84) : 1-152.
- WHITEHEAD P.J.P. & MYERS G.S., 1971. — The problems of nomenclature and dating of Spix and Agassiz's *Brazilian fishes* (1829-1831). *J. Soc. Bibliophy nat. Hist.*, 5 (6) : 478-497.
- WHITEHEAD P.J.P., SMITH P.J. & ROBERTSON D.A., 1985. — The two species of sprat in New Zealand waters (*Sprattus antipodum* and *S. muelleri*). *N.Z. Jl. mar. freshw. Res.*, 19 : 261-271.
- WHITEHEAD P.J.P., VAN VLIET G. & STEARN W.T. (in press). The Clusius and other natural history drawings now in the Jagiellon Library, Cracow. *Arch. nat. Hist.*
- WHITLEY G.P., 1939. — Ichthyological genotypes : Desmarest's designations, 1874. *Aust. Zool.*, 9 (3) : 222-226.

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